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Indian Standard

FIREWORKS ROCKETS — SPECIFICATION

UDC 662.114

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

November 1990 **Price Group 3**

Explosives and Pyrotechnics Sectional Committee, CHD 26

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Explosives and Pyrotechnics Sectional Committee had been approved by the Chemical Division Council.

The fireworks rockets are normally used for the purpose of entertainment. The production of this item in India is confined to the small scale and cottage industries. It is strictly an outdoor item which when fired by lighting the fuse, blasts off vertically into the air, followed by a plume of burning propellant. A display component of either a sound producing firecracker or light and colour producing pellet functions at the maximum height reached.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 AUGUST 1996
TO
IS 12980 : 1990 FIREWORKS ROCKETS — SPECIFICATION

(*Page* 1, *clause* 2.1) — Substitute the following for the existing text:

The Indian Standards listed below are the necessary adjuncts to this standard:

IS No.	*Title*
301 : 1982	Potassium nitrate for explosive and pyrotechnic compositions (*second revision*)
1070 : 1992	Reagent grade water (*third revision*)
4905 : 1968	Methods for random sampling

(Page 1, *clause* 5, *Title)* — Substitute '**SIZES**' *for* '**GRADES**'.

(*Page* 1, *clause* **5.1**) — Substitute the following for the existing text:

'The fireworks rockets shall be of five sizes according to the requirement given in **6.1.6.'**

(*Page* 1, *clause* **6.1**) — Substitute the following for the existing text and renumber the subsequent clauses accordingly:

'6.1 Material and Construction

6.1.1 *Composition* — The chemical composition of pyrotechnic charge of fireworks rockets shall be as approved by the Chief Controller of Explosives.

6.1.2 *Chlorate Content* — The pyrotechnic composition, both in shell as well as in display component, shall be found to contain no chlorate when tested by the method prescribed in Annex A.

6.1.3 *The Shell* — The shell shall be made of kraft paper or paperboard, housing the propellant charge and the display component, and shall be of cylindrical shape all through its length. A nozzle shall be provided by means of either throttling the tube or by means of pierced hole through hardness earth or saw dust mixture. The diameter of the nozzle shall be such as to provide a good velocity for toe rocket to push off vertically. The main shell shall have an empty extension below the nozzle in order to provide the propulsion chamber (*see* Fig. 1 and 2).

6.1.3.1 The shell, when pressed hard at any place by means of thumb and index finger, shall not be deformed.

6.1.3.2 The shell shall not be made of any metal.

6.1.4 *The Stabilizer* — The stabilizer shall be straight, smooth, unbroken and uncracked all through its entire lenglh. The length of the stabilize shall be at least 5.5 times the height of the shell.

6.1.5 *The Fuse* — In all cases, the lenglh of the quick match (fixed firmly through the nozzle by means of a priming composition) shall be not less than 30 mm outside the nozzle.

6.1.6 The nominal length and diameler of the shell, mass of pyrotechnic mixture and height of flight of the fireworks rockets shall be as follows

Size	*Length of the Shell*	*Diameter of the Shell*	*Mass of Chemical Composition, Min*	*Height of Flight Min*
	cm	cm	g	m
1	7.5 ± 0.1	1.5 ± 0.1	7 0	20.0
2	5.5 ± 0.1	1.5 ± 0.1	3 5	16.0
3	4.5 ± 0.1	1.5 ± 0.1	3.0	15.0
4	3.5 ± 0.1	1.5 ± 0.1	1.5	15.0
5*	7.5 ± 0.1	1.5 ± 0.1	8.0	40.0

*For whistling fireworks rockets only

6.1.7 The centre of gravity of the fireworks rocket shall be at a point 10 ± 1 mm below the lower edge of the propulsion chamber, when tested by the method prescribed in Annex B.

6.1.8 *Damp Proofness* — Fireworks rockets shall pass the test for damp proofness when tested by the method prescribed in Annex C.'

[*Page* 3, *clause* **7.2**(a)] — Substitute 'size' *for* 'grade'.

(*Page* 3, *Annex* A, *Reference*) — Substitute *'Clause* 6.1.2' *for* *'Clause* 6.1.1'.

(*Page 4, Annex* B, *Reference*) — Substitute *'Clause* 6.1.7' *for 'Clause* 6.1.6'.

(*Page* 4, *Annex C, Reference)* — Substitute *'Clause* 6.1.8' *for 'Clause* 6.1.7'.

(CHD 026)

Reprography Unit, BIS, New Delhi, India

Indian Standard

FIREWORKS ROCKETS — SPECIFICATION

1 SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for fireworks rockets.

2 REFERENCES

2.1 The following Indian Standards are the necessary adjuncts to this standard:

IS No.	*Title*
301 : 1982	Potassium nitrate for explosive and pyrotechnic compositions (*second revision*)
4905 : 1968	Methods for random sampling
1070 : 1977	Water for general laboratory use (*second revision)*

3 TERIMINOLOGY

3.1 Fireworks Rockets

They are a type of fireworks used chiefly for the purpose of entertainment. They essentially consist of the shell made of paperboard containing the solid propellant charge of gun powder/black powder or any pyrotechnic composition as approved by the Chief Controller of Explosives, the quick match, the display component and a stabilizer fixed firmly to the side of the shell vertically. When fired by lighting the fuse, it pushes off vertically into the air followed by a plume of burning propellant. The display component of either a sound producing firecracker or light and colour producing pellet functions at the maximum height reached.

3.2 Propellant Charge

This is essentially a non-flashing black powder/gun powder composition of potassium nitrate (*see* IS 301 : 1982), sulphur and charcol in an intimate and homogeneous mixture densely compacted or a pyrotechnic composition approved by the Chief Controller of Explosives.

3.3 Stabilizer

This is a long rigid, cylindrical piece of stick generally made of plant or straw of bamboo stick which maintains the vertical stability of the fireworks rocket during motion.

4 TYPES

4.1 The fireworks rockets shall be of the following types:

a) *Type I* — The fireworks rockets which push off vertically into the sky and produce white or coloured light at its maximum height.

b) *Type II* — The fireworks rockets which push off vertically and produce sound at its maximum height.

c) *Type III* — The fireworks rockets which push off vertically accompanied by whistling sound and produce sound or colour or white light at its maximum height.

5 GRADES

5.1 The fireworks rockets shall be of five grades according to the requirements given in **6.1.5**.

6 REQUIREMENTS

6.1 Material and Quality

6.1.1 *Chlorate Content*

The mixture of pyrotechnic material, both in shell as well as display component shall be found to contain no chlorate when tested by the method given in Annex A.

6.1.2 *The Shell*

The shell made of kraft paper or paperboard, housing the propellant charge and the display component shall be of cylindrical shape all through the length. A nozzle shall be provided by means of either throttling the tube or by means of pierced hole through hardness earth or saw dust mixture. The diameter of the nozzle shall be such as to provide a good velocity for the rocket to push off vertically. The main shell shall have an empty extension below the nozzle in order to provide the propulsion chamber (*see* Fig. 1 and 2).

6.1.2.1 The shell when pressed hard at any place by means of thumb and the index finger shall not be deformed.

6.1.2.2 The shell shall not be made of any metal.

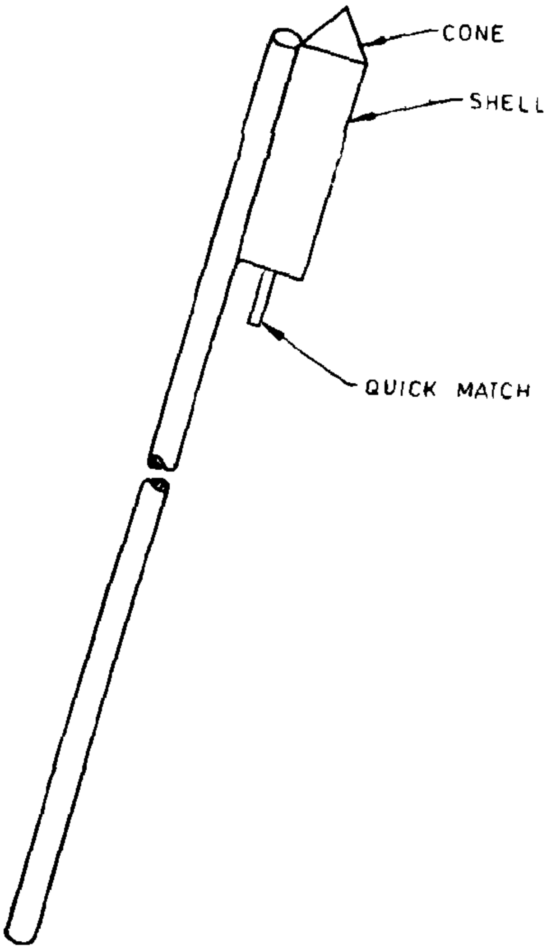

FIG. 1 FIREWORKS ROCKET

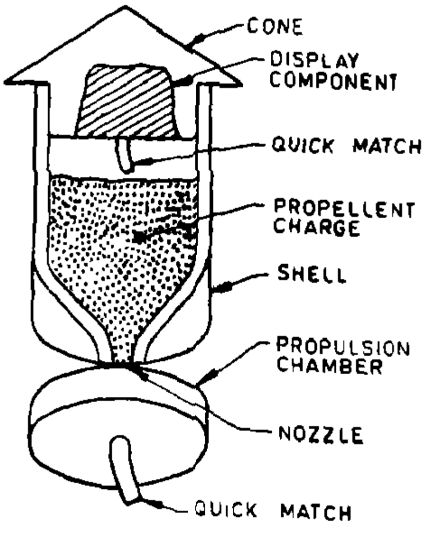

FIG. 2 SHELL (SHOWN BROKEN)

6.1.3 *The Stabilizer*

The stabilizer shall be straight, smooth, unbroken or uncracked all through the entire length. The length of the stabilizer should be at least 5.5 times the height of the shell.

6.1.4 *The Fuse*

In all cases, the length of the quick match (fixed firmly through the nozzle by means of a priming composition) shall be not less than 30 mm outside the nozzle.

6.1.5 The nominal length of shell, diameter of shell, mass of pyrotechnic mixture and height of flight of the fireworks rockets shall be as follows:

Grade	Length of the Shell cm	Diameter of the Shell cm	Mass of Chemical Composition g	Height of Flight, Min m
1	7 5±0.1	1.5±0.1	7 0±0.5	20.0
2	5.5±0.1	1.5±0.1	3.5±0.3	16.0
3	4.5±0.1	1.5±0 1	3.0±0.2	15.0
4	3.5±0.1	1.5±0.1	1.5±0.2	15.0
5*	7.5±0.1	1 5±0.1	8.0±0.5	40.0

*For whistling fireworks rockets.

6.1.6 The centre of gravity of the fireworks rocket shall be at a point 10±1 mm below the lower edge of the propulsion chamber, when tested by the method prescribed in Annex B.

6.1.7 *Damp Proofness*

Fireworks rockets shall pass the test for damp proofness when tested by the method prescribed in Annex C.

6.2 Performance Requirements

6.2.1 The fuse shall burn uniformally, without jerks, leading fire to the propellant charge inside the shell. The burning time of the fuse shall be not less than 3 seconds and not more than 6 seconds. This is achieved by appropriating the burning rate of the fuse and the length of the fuse.

6.2.2 The fireworks rocket when fired from a vertical position supported by an external contrivance shall rise vertically into the air. It shall not deviate to an angle of more than 10 degrees from the vertical (*see* Annex D) It shall have same rate of propulsion. The propellant shell shall not explode midway of the climb

6.2.3 In case of whistling fireworks rocket, it shall produce whistling sound throughout its flight.

6.2.4 The display component shall function at the maximum height reached by the rocket.

6.2.5 The shell with stabilizer shall fall on the ground, only after exhausting the fire spark.

7 PACKING AND MARKING

7.1 Packing

The fireworks rockets shall be packed in suitable cardboard boxes. The fireworks rockets shall *be* packed in boxes of ten. Ten such boxes shall be packed in packets.

7.2 Marking

Each box shall be legibly and indelibly marked with the following information;

a) Name, type and grade of the material;
b) Indication of the source of manufacture;
c) Batch number, in code or otherwise, to enable the lot of manufacture to be traced from records; and
d) Date of manufacture.

7.2.1 In addition to the above, the following cautionary note shall also appear on the label:

> DO NOT HOLD IN HAND. PLACE IN A ROCKET-LAUNCHING DEVICE IN OPEN GROUND. IGNITE FUSE AND GET AWAY. USE OUTDOORS ONLY AND UNDER ADULT SUPERVISION.'

8 TEST METHODS

8.1 Tests for the requirements laid down in **6** shall be carried out as prescribed in Annexures A to D of this standard.

8.2 Quality of Reagents

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070 : 1977) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

9 SAMPLING

9.1 Represnetative samples of the material shall be drawn and conformity of the material to the requirements of the specification shall be determined according to the procedure prescribed in Annex E.

ANNEX A

(*Clause* 6.1.1)

TEST FOR CHLORATE

A-1 REAGENT

A-1.1 Aniline (Fresh)

A-1.2 Concentrated Hydrochloric Acid

A-1.3 Aniline Hydrochloride Solution

Dissolve 18 g of distilled aniline in 375 ml of concentrated hydrochloric acid and make the volume to 500 ml with water. Add 2 drops of potassium chlorate solution, shake well and allow to stand overnight. Filter off the blue sediment. Store the reagent in a glass stoppered bottle in the dark.

A-2 PROCEDURE

A-2.1 Take 5 0 g of the pyrotechnic composition in a 250-ml beaker. Add 50 ml of water and stir well. Digest for 2 minutes by slight warming. Allow it to cool and then filter. To the filtrate add 50 ml of aniline hydrochloride reagent.

A-2.2 No blue colour shall develop when kept for 10 minutes.

ANNEX B

(*Clause* 6.1.6)

TEST FOR CENTRE OF GRAVITY

B-1 APPARATUS

B-1.1 One sharp metal piece (knife) of size 10 cm × 2 cm fitted with a wooden handle as shown in the Fig 3.

B-2 PROCEDURE

B-2.1 Take a piece of fireworks rocket with stabilizer stick Place the rocket over the sharped edge of knife at the point 10 mm below the lower edge of the propulsion chamber and then balance it. If the rocket with the stick stands horizontally over the knife, it is considered passing the test. The minimum 10 sample shall tested

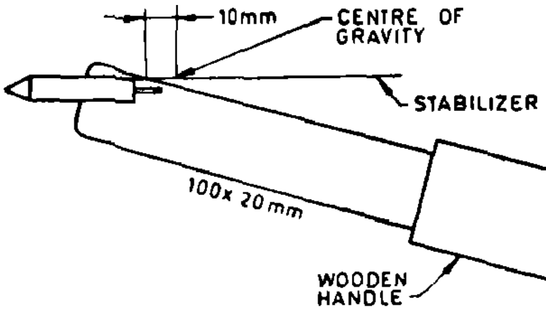

FIG. 3 DETFRMINATION OF VERTICAL PROPULSION OF FIRFWORKS ROCKETS

ANNEX C

(*Clause* 6.1.7)

TEST FOR DAMP PROOFNESS

C-1 EQUIPMENT

C-1.1 Equipment include one set of wet and dry thermometer and humidity control device. Provision for timer should be given. Separate control panel houses individual switches for heating, humidification indicators, thermostat, etc. Suitable to work on 220 V, 50 cycles, AC supply. Size of the humidity oven shall be 710 × 455 × 455 mm.

C-2 PROCEDURE

C-2.1 Fireworks rockets shall be placed in the humidity oven. Humidity should be maintained at 75 percent and temperature at 27° ± 2°C. After 12 hours, fireworks rocket shall be tested for performance requirements to **6.2**. When the rockets are removed from the oven and kept in vertical condition, the rocket tube with its weight shall not bend or get detached from the stick. If it performs well and does not get detached from the stick, the rocket is considered passing the test.

ANNEX D

(*Clause* 6.2.2)

TEST FOR VERTICAL PROPULSION OF ROCKETS

D-1 APPARATUS

D-1.1 The apparatus consists of a wooden base at the centre of which a long uniform wooden bar is fitted vertically. At the other end of this wooden bar, are fitted two wooden pieces, perpendicular to each other and also to the central supporting bar. The lengths of these bars and the height at which they are to be fitted are appropriated so that the four lines joining the centre point of the base and edges of the upper cross bars describe each an angle of 10° with the central bar (*see* Fig 3).

D-2 PROCEDURE

D-2.1 The rocket is held vertically by some external contrivance at the base very near to the central supporting bars. (A cylinderical tube attached to the central supporting bar may serve the purpose.) It is then fired The rocket rs considered to have passed the test, if it does not exceed the limit of the edge of the upper cross-bars.

D-2.2 The rocket during flight may be observed with the help of a sextant at a distance *(D)* from the initial position of the rocket. Angle of elevation *(θ)* of the maximum point the rocket reached, can be measured, from the distance at the angle of elevation. The height *(H)* is calculated as given below:

$$H = D.\tan\theta + h$$

where

H = Maximum height,

θ = Corresponding angle of elevation, and

h = Rocket height.

ANNEX E

(*Clause* 9.1)

SAMPLING OF FIREWORKS ROCKETS

E-1 SCALE OF SAMPLING

E-1.1 Lot

All the boxes of fireworks rockets of the same grade and belonging to the same batch of manufacture shall constitute a lot.

E-1.2 For ascertaining the conformity of the material to the requirements of the specification, samples shall be tested from each lot separately

E-1.3 The number of boxes to be selected from a lot shall depend on the size of the lot and shall be according to Table 1.

E-1.3.1 The packets from the lot and boxes from the packets shall be selected at random. In order to ensure the randomness of selection, procedures given in IS 4905 : 1968 may be followed.

E-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

E-2.1 From the number of boxes selected according to col 3 of Table 1, the number of boxes given in col 4 of Table 1 shall be randomly chosen. From these boxes six pieces of fireworks rockets shall be randomly selected so that each box is represented and subjected to the test for damp proofness given in **6.1.7.**

E-2.1.1 The lot shall be considered to have satisfied the requirements of damp proofness if all the fireworks rockets in the sample satisfy the corresponding requirement.

E-2.2 The lot having been found satisfactory according to **E-2.1,** shall be further tested for the requirements given in **6.1, 6.2** and **6.3**. For this purpose, the numbero f boxes given in col 5 of Table 1

Table 1 Scale of Sampling for Fireworks Rockets

(*Clause* E-1.3)

No. of Boxes in the Lot	No. of Packets to be Selected	No. of Boxes to be Selected	No. of Boxes to be Selected for Damp Proofness	For Requirements given in 6.1.2 to 6.1.6			No. of Tests for the Requirements Given in 6.1.1 and 6.2
				No. of Boxes to be Selected	No. of Fireworks to be Selected	Permissible No. of Defectives	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Up to 500	2	6	2	4	13	1	1
501 to 1 000	3	9	3	6	20	2	2
1 001 to 3 000	5	12	4	8	32	3	3
3 001 to 10 000	5	15	5	10	50	5	4
10 001 and above	10	21	6	15	80	7	5

shall be used. These shall be the boxes remaining out of the boxes selected according to col 3 of Table 1 (after taking the number of boxes required for damp proofness according to **E-2.1**). From each of the boxes so selected, approximately equal number of fireworks rockets shall be selected so as to constitute the requisite sample size given in col 6 of Table 1. Any fireworks rockets failing to satisfy one or more of these requirements shall be considered as defective.

E-2.2.1 The lot shall be considered to have satisfied these requirements if the number of defectives found in sample is less than or equal to the corresponding permissible number of defective given in col 7 of Table 1.

E-2.3 The lot having satisfied the requirements given in **E-2.1** and **E-2.2** shall be finally tested for the remaining requirements given in **6.1.1** and **6.2.** For this purpose, the number of tests to be conducted for each of these requirements is given in col 8 of Table 1. The required number of fireworks rockets for carrying out these tests shall be selected from those boxes already tested according to **E-2.2** and found satisfactory.

E-2.3.1 The lot shall be considered to have satisfied these requirements if no failure occurs.

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